EFFICACY OF ONE-LEGGED VS TWO LEG EXERCISE TRAINING IN ENHANCINGAEROBIC CAPACITY OF PATIENTS OF COPD

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EXAMINERS

1.

2.

A Project submitted to

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In partial fulfillment for the requirement of the degree of

MASTERS OF PHYSIOTHERAPY

OCTOBER- 2017

CERTIFICATE

This is to certify that the project **title "EFFICACY OF ONE-LEGGED VS TWO LEG EXERCISE TRAINING IN ENHANCINGAEROBIC CAPACITY OF PATIENTS OF COPD** is a bonafide record of work done under by guidance supervision in the partial fulfillment for the degree of **MASTER OF PHYSIOTHERAPY(M.P.T IInd Year - OCTOBER 2017**) by **RANJITH JOEL SIMEON.P** Register Number: 27113242Post graduate student of Madha College of Physiotherapy.

GUIDE

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PRINCIPAL

Prof. V. VIJAI KRISHNA, **MPT., MIAP**

ACKNOWLEDGEMENT

Firstly, I express my immense gratitude to MY GOD ALMIGHTY for his abundant grace and mercy that enabled me to venture in every part of my life. With a grateful heart I would also like to thank my thesis advisor and Principal Prof. **V.VIJAIKRISHNA MPT, MIAP**. The door to Prof. **V.VIJAIKRISHNA MPT, MIAP** office was always open whenever I ran into a trouble spot about my research. He consistently steered me in the right the direction whenever he thought I needed it.

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In addition, I am gratefully indebted to Associate Prof. **MRS.MERCY CLARA** M.P.T., **MIAP** for her very valuable support and knowledgeable comments on this thesis.

Finally, I must express my very profound gratitude and dedicate my thesis to my parents, my wife and baby Nathania for providing me with unfailing support and continuous encouragement throughout my years of study and through the process of researching and writing this thesis. This accomplishment would not have been possible without them. Thank you.

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is the most common disorder affecting 10-15% of adult over the age of 40. COPD is a disorder characterized by the presence of air flow obstruction that is generally progressive may be accompanied by airway hyper reactivity and may partially reversible.

COPD patients shows marked decrease in the lung volumes and lung capacities leads to decrease arterial oxygen saturaisation level and over all it affects the aerobic and exercise tolerance capacity of the persons. In initial stage it produces hypoxemia and in later stage hypercapnia will occur.

The cornerstone of pulmonary rehabilitation is exercise training based on the premise that altering physiologic process will result in improved outcomes. Intensity and duration are important determinants of the physiologic adaptation that occur in response to exercise.

COPD patients are so limited by dyspnea,even at modest level of ventilation that their training is restricted to low intensity exercise. As a result, when undergoing exercise training they are usually unable to increase their peak oxygen uptake (vo_2)) although this measuresis the recognized standard for confirming the physiologic effects of aerobic exercise training.COPD patients undergoing conventional two-legged training are unable to increase their peak (vo_2) because of ventilator limitation.

One legged cycle training required no specific learning and patients found it at least as comfortable as two-legged training because leg fatigue is better tolerated than dyspnea. One legged cycle training placed the same metabolic and functional demands on the targeted muscle,at a lower total metabolic load and hence a lower ventilator load.(Rogers. goldstein 2005)

STATEMENT OF THE STUDY

Effectiveness of ONE leg exercise training on improving aerobic capacity in patients with COPD.

NEED OF THE STUDY

In COPD exercise training is limited by dyspnoea and their aerobic capacity also decreased.COPD patients are unable to increase their peak oxygen uptake (vo_2). It is known that one leg exercise training improves aerobic capacity.

AIM OF THE STUDY

The aim of study is to find out the effectiveness of one – lag exercise training in improving aerobic capacity for patients with COPD against two – lag exercise training.

OBJETIVES OF THE STUDY

- To find the effectiveness of one – legged exercise training in improving aerobic capacity for patients with COPD.
- To find the effectiveness of two – legged exercise training in improving aerobic capacity for patients with COPD.
- To compare the effects of both on improving aerobic capacity for patients with COPD

HYPOTHESIS

Alternate Hypothesis

There will be significant difference between one – legged and two – legged Exercise training in improving aerobic capacity for patients with COPD.

Null Hypothesis

There will be no significant difference between one–legged and two – legged exercisetraining in improving aerobic capacity for patients with COPD.

OPERATIONAL DEFINITIONS

COPD

COPD is a disorder characterized by the presence of air flow obstruction that is generally progressive may be accompanied by airway hyper reactivity and may partially reversible.

VO_2 MAX

O_2 max (also maximal oxygen consumption, maximal oxygen uptake, peak oxygen uptake or aerobic capacity) is the maximum capacity of an individual's body to transport and use oxygen during incremental exercise, which reflects the physical fitness of the individual.

SpO_2

Oxygen saturation or dissolved oxygen (DO) is a relative measure of the amount of oxygen that is dissolved or carried in a given medium. It can be measured with a dissolved oxygen probe such as an oxygen sensor or in liquid media, usually water.

REVIEW OF LITERATURE

1. WHO

COPD is a disorder characterized by the presence of air flow obstruction that is generally progressive may be accompanied by air way hyper reactivity and may partially reversible.

2. THOMAS E.DOLMAGE (2005)

COPD patients undergoing conventional two-legged exercise training are unable to increase their peak Vo_2because of ventilator limitation.

3. DAVIS CT, SARGEANT, (1974)

COPD Patients cannot tolerate conventional high intensity exercise for sufficient time to induce changes in peripheral muscle metabolism.

4. RICHARDSON et al (2007)

Reported that a metabolic reserve existed during single leg extension exercise .Rhythmic extension of one leg which used a working muscle mass of only 12.5% of the muscle mass required for cycling, required 80% of the ventilator capacity.

5. THOMAS E. DOLMAGE (2006)

Patients with COPD, exercise are limited by the inability to increase ventilation to meet the metabolic demand. Exercise may also be limited by peripheral muscle dysfunction consequent on decrease muscle mass, decrease capillaries,decrease mitochondrial volume and also activity of oxidative enzyme.

6. ROGERS.GOLDSTEIN (2005)

One legged cycle training required no specific learning, and patients found it at least as comfortable as two legged training because leg fatigue is better tolerated than dyspnea. One legged cycle training does not preclude other strategies to improve exercise tolerance, such as supplemental oxygen, mechanically ventilated assistance.

7. MILLER, MR (2006)

One legged cycle training enhances the adaptive response of peripheral muscle, resulting in increased peak (Vo2), PPK, and peak$V_{E.}$

8. ACEVEDOEO (2007)

COPD patients achieved more work when cycling with one leg. Despite the same load being applied to the muscle. One leg exercise placed same metabolic and functional demand on the targeted muscle, at a lower metabolic load, and hence a low ventilator load.

9. DOLMAGE (2008)

One leg exercise, at half the load of two legged exercise will place the same demand on the muscles, but as the total metabolic load, and therefore the ventilator load is less than two legged exercise.

10. WAGNER.P(1986)

During exercise, there is a lag between (Vo2), and the instaneous increase in power. The greater proportion of cardiac output diverted to the smaller working muscle mass during one leg incremental exercise may have reduce this lag, resulting in increased(Vo2)at a given sub maximal work load.

DESIGN AND METHODOLOGY

RESEARCH DESIGN

Matched subject experimental design

STUDY SETUP

MIOT HOSPITALS, CHENNAI, GLOBAL HOSPITAL AND HEALTH CITY,CHENNAI

SAMPLING CRITERIA

Inclusion Criteria

1. Clinically stable COPDpatients
2. Male subjects
3. Age group 40-65
4. Subject with smoking abstinence

Exclusion Criteria

1. Subjects with other pulmonary disorders
2. Subjects with osteoporosis and tuberculosis
3. Subjects with hypoxemia at rest
4. Subjects with neurological conditions

POPULATION

All COPD patients, who fulfill the inclusion criteria, were included in this study

SAMPLE SIZE

Total sample size is 30.They were selected from the population by using convenient sampling procedure.

Group-I

Single leg exercise training(**experimental group**)

Group-II

Double legged exercise training(**controlled group**)

VARIABLES

Depandant Variables

VO^2 Max

SpO_2

Independent Variables

1. Single legged exercise training

2. Double legged exercise training

MATERIAL USED

1. Bicycle ergo meter

2. Pulse oximeter

METHODOLOGY

Group-I was receiving Single leg exercise training & GROUP-II was receiving double leg exercise training.

Before giving the independent variables for each group an assessment was taken and pre test scores of VO2 Max and Sao2 were recorded.

GROUP-I

Before starting the exercise program clear explanation about the training was explained to the subjects.

Single leg exercise training was given in Electro mechanically bracked cycle. The inactive foot was rested on a cross bar located midway on the ergo meter head tube. The first half of the training was given in right leg and the other half of training was given on the left leg. (15 minutes on each leg)

The intensity was set as 50% of the peak power and reduced as necessary to achieve 30 minutes of cycling. In the first week of the program subjects were trained at40% peak power. Once the subject reached 30 min for consecutive session, then the training workload was increased about 5%.

This training program was given three times per week for six months.

After the administration of Single leg exercise training the post test scores of VO_2 Max and SaO_2 were recorded. The other parameters mainly heart rate, blood pressure, and dyspnea are also recorded during the test.

GROUP-II

Before starting the exercise program clear explanation about the training was explained to the subjects.

Subjects were instructed to do cycling continuously for 30 minutes. The training was given in in Electro mechanically bracked cycle. The training intensity was 70%of the peak power.. In the first week of the program subjects were trained at56%peak power. Once the subject reached 30 min for consecutive session, then the training workload was increased about 5%. This training program was given three times per week for six months.After the administration of Single leg exercise training the post test scores of VO2 Max and Sao2 were recorded.The other parameters mainly heart rate, blood pressure, and dyspnea are also recorded during the test.

DATA ANALYSIS

INTRODUCTION

The present chapter deals with the important aspect of investigating data collected on VO_2Max and SPO_2 of 30 sampled subjects to answer research questions through employing suitable statistical techniques.

A sample of 30 chronic obstructive pulmonary disease subjects matched on baseline characteristics were selected through simple random sampling and were divided into two equal groups of 15 in each. One group was treated with single leg exercise training and other group was treated with double leg exercise training. The data on VO_2Max andSPO_2 was carefully assessed and recorded through the reliable and valuable instrument of radio telemetric bicycle ergo meter and pulse oximeter with full of accuracy.

Chronic obstructive pulmonary disease has been given on examine the data and various analytical technique to synthesis the research data. The data were put into suitable statistical technique using spss for window version 17.0

TABLE 4.1 MEAN, STANDARD DEVIATION, RANGE FOR GROUP I

Vari-ables	PRE TEST				POST TEST				% of Increase
	Mean	SD	Range	SEM	Mean	SD	Range	SEM	
VO_2Max	0.875	.32721	.679-.985	.14172	1.064	.4630	.792-1.336	1.12014	21.88
SPO_2	90	1.05412	87-92	.28362	92	1.0243	89-93	2.27450	26.57

The statistical outcomes of descriptive measures of VO_2Max and SPO2 before and after single leg training are glanced in Table 4.1.

The observed mean 0.875of with standard deviation of .32721 of VO_2Max for single leg training before the interventions is increased to the mean of 1.064 with standard deviation of .4630 of VO_2Max after the intervention the percentage is increased in 21.88% with the range changed from .679-.985 to .792-1.1336

The observed mean of 90 with standard deviation of 1.05412 of SPO2 before the interventions is increased to the mean of 91 and with standard deviation of 0.1243 of SPO2 after the intervention. The percentage is increased in 26.57% with the range changed from 87-92 to89-93.

TABLE 4.2 MEAN, STANDARD DEVIATION, RANGE FOR GROUP II

Vari-ables	PRE TEST				POST TEST				% of Increase
	Mean	SD	Range	SEM	Mean	SD	Range	SEM	
VO_2Max	0.894	0.5096	.600-1.210	.1303	.900	.3640	.652-1.132	.2506	12.93
SPO_2	91	.8791	87-90	1.12714	93	0.89569	88-91	0.24612	15.78

The statistical outcomes of descriptive measures on VO_2Max and SPO_2 before and after the administration of double leg training are glanced in Table 4.2.

The meanVO_2Max before intervention was 0.894 and standard deviation of 0.5096 and it increased to mean VO2Max as mean of .900 with standard deviation of .3640after the intervention the range also found to be increased from .600-1.210 to .652-1.132 and 12.93% of increase.

The mean SPO_2 before intervention was 93 and standard deviation of 0.8791 and it increased to mean SPO2 as 92 with standard deviation of 0.89569 after the intervention. The range also found to be increased from87-90 to 88-91 and 15.78% of increase.

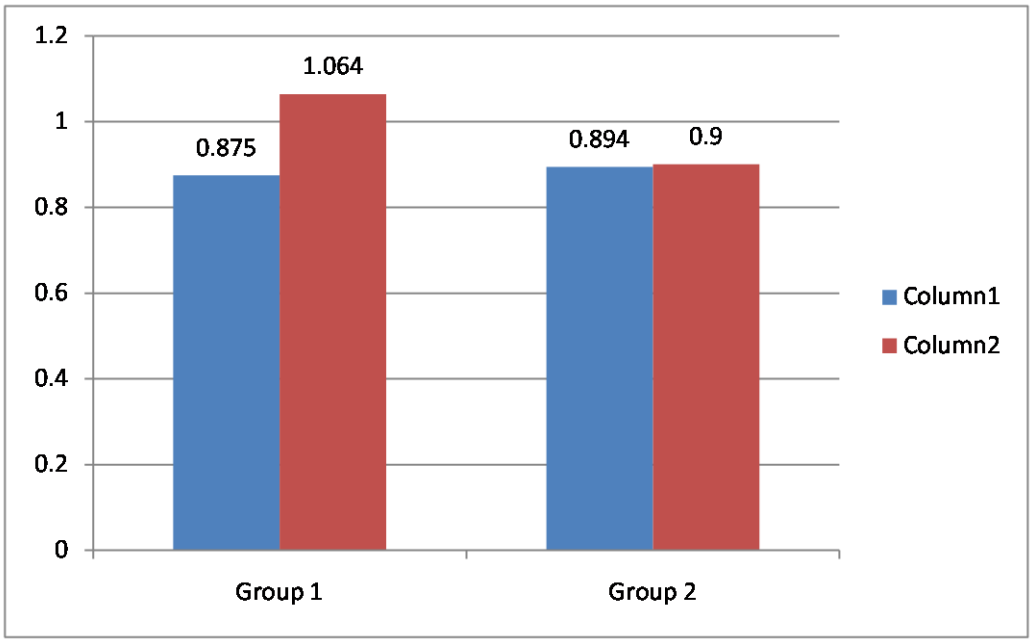
TABLE 4.3

VARIABLES	GROUP	N	MEAN	SD	SIG
VO_2Max	EXPT(I)	15	1.064	.4630	.000
	CONT(II)	15	0.900	.3640	.000
SPO_2	EXPT(I)	15	92	1.024	.000
	CONT(II)	15	91	.89569	.000

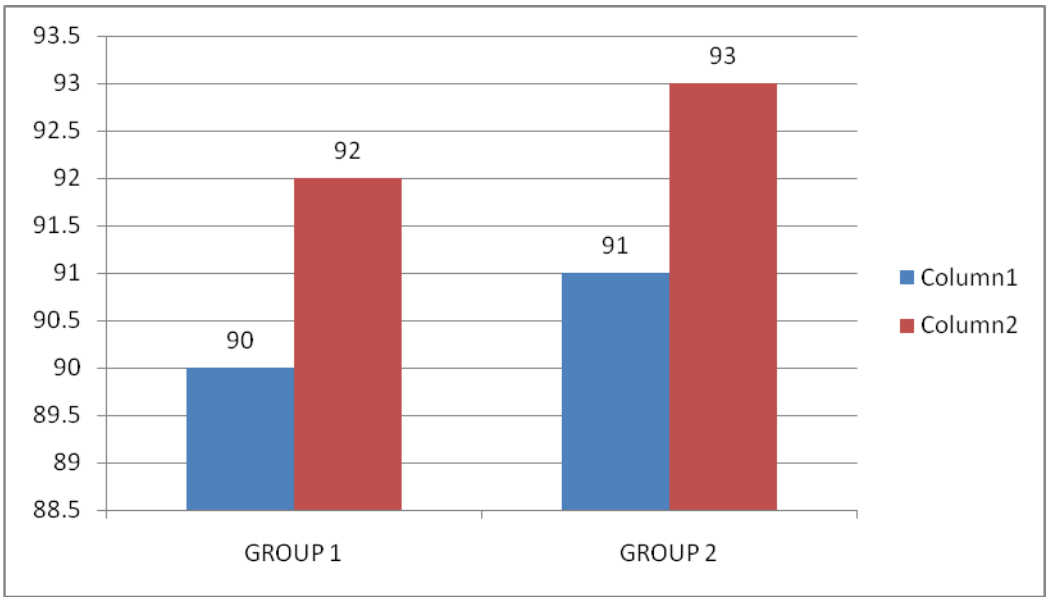
The table 4.3 shows the mean of VO_2Max in Group I is1.064 and is Group II is .900. The result shows that there is a significant difference between the groups

The mean SPO_2inGroup I is 92 and in Group II is 91. The result shows that there is a significant difference between the groups

4.1 COMPARISON OF MEAN OF VO2 MAX IN GROUP 1 AND GROUP 2



4.2 COMPARISON OF MEAN OF SPO2 IN GROUP 1 AND GROUP 2



RESULTS AND DISCUSSION

RESULTS

The study was done on 30 subjects, which consisted of 15 subjects each for 15days duration.

The results show that:

1. Mean value of independent variable between pre and post score of Group-I shows significant difference in improvement.

2. Mean value of different variable between pre and post scoreof Group-II shows less significant difference in improvement.

3. Paired't' tests value of pre and post score shows significant difference in experimental group.

4. Paired't' tests value of pre and post score shows less significant difference in control group.

5. In Paired't' tests of experimental group shows highly significant difference in improving Aerobic capacity on COPD patients.

6. The mean difference of experimental group shows significant difference in improving Aerobic capacity on COPD patients.

7. The mean difference of control group shows less significant difference in improving Aerobic capacity while comparing to experimental group.

DISCUSSION

30 subjects were taken to compare the effectiveness of single leg trainingverses double leg training. In this study the statistical analysis showed that effective in improving in lung function than conventional chest physiotherapy.

The result of the study showed thatsingle leg trainingshowed significant in aerobic capacity in COPD patients than double leg training.

Statistical mean value of single leg trainingofpre test and post test score were 0.875\90. to1.064\92 by experimental group.The post test score shows significant in aerobic capacity than the pre test score in COPD patients.

Statistical mean value of the double leg training of pre test and post test score were.894\91 to.900\93 by control group. The post test score shows less significant in aerobic capacity than the pre test score in COPD patients.The above mentioned statistical outcomes also supports the results of this study

One legged cycle training required no specific learning, and patients found it at least as comfortable as two legged training because leg fatigue is better tolerated than dyspnea. One legged cycle training does not preclude other strategies to improve exercise tolerance, such as supplemental oxygen, mechanically ventilated assistance(ROGERS.GOLDSTEIN (2005))

COPD patients achieved more work when cycling with one leg. Despite the same load being applied to the muscle. One leg exercise placed same metabolic and functional demand on the targeted muscle, at a lower metabolic load, and hence a low ventilator load,ACEVEDOEO (2007) also supports the statement of this study

LIMITATION OF THE STUDY

- The study was limited only to a specific age group

- Sample size of the study was small to derive accurate conclusion.
- The duration is six months and here the long term improvements in lung function with this improvement program are not obvious with this study.

SCOPE FOR FURTHER STUDY

- Similar study can be concluded on large sample.
- Duration of the study can be increased.

CONCLUSION

From the result of the study it was concluded that single leg exercise training is effective in improving aerobic capacity in Chronic Obstructive Pulmonary Disease patients.

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ROGER S.GOLDSTEIN, MD

PERFORMA

Name :

Age :

Gender : Male/Female

Occupation :

Marital status : Single/Married/Widowed/Divorced

Chief complaints :

a. Cough :

b. Sputum :

c. Wheeze :

d. Duration :

e. Dyspnea :

f. Other chest illness :

Past medical history :

Occupational history :

Personal history : Smoking/Alcoholic

Family history :

Medical history : Medications/Inhalers/Nebulizers

Socio-economic history :

VITAL SIGNS

i. Heart rate :

ii. Pulse :

iii. Blood pressure :

iv. Respiratory rate :

v. Temperature :

ON OBSERVATION

General appearance :

Cyanosis : Central/Peripheral

Breathing pattern :

Head and neck:

Facial expression, type and pattern of breathing jugular vein enlargement, hypertrophy accessory muscles of respiration.

Periphery :

Clubbing of digits :

Chest shape and posture :

Gait :

PALPATION

Symmetry of chest movement :

Chest expansion :

Axilla :

Xiphoid :

Subcostal :

Position of trachea :

Fremitus :

PERCUSSION

AUSCULTATION :

1. Heart Sounds :
2. **2.** Breath Sounds :

INVESTIGATION :

1. Chest X ray :
2. Sputum culture sensitivity :
3. Bronchoscopy :
4. CT chest :
5. Pulmonary Function Test :

VARIABLES	**PRE TEST**	**POST TEST**
VO_2Max		

SPO_2		

Signature of the Investigator **Signature of the Subject**

MASTER CHART

Sl. No	Experimental Group				Control Group			
	VO_2 Max		SPO_2		VO_2 Max		SPO_2	
	Pre-test	Post – test	Pre – test	Post-test	Pre-test	Post-Test	Pre-Test	Post - test
1	0.5475	0.6010	88.94588	90.9757	0.3854	0.536	90.1209	92.10431
2	0.6220	0.7450	89.00150	91.0025	0.4789	0.597	90.2254	92.15478
3	0.7400	0.6840	89.00589	91.1456	0.4701	0.645	90.3254	92.20487
4	0.7600	0.7980	89.12456	91.2891	0.5874	0.715	90.5648	92.34571
5	0.8050	0.8450	89.22489	91.6001	0.6487	0.725	90.6548	92.56457
6	0.8250	0.8840	89.34897	91.6987	0.6954	0.825	90.7548	92.78456
7	0.8450	0.9750	89.41458	91.8974	0.8457	0.892	90.8987	92.89745
8	0.8750	1.0640	89.98745	92.0000	0.8940	0.900	91.000	93.00000
9	0.9210	1.1250	90.14785	92.2999	0.9124	0.925	91.1247	93.10124
10	0.9540	1.1970	90.58974	92.3564	o.9875	1.005	91.2487	93.11457
11	0.9560	1.2950	91.02789	92.4567	1.1356	1.025	91.3662	93.34567
12	0.9220	1.3720	91.03789	92.6897	1.2450	1.123	91.4789	93.45678

13	**1.0200**	**1.3920**	**91.04589**	**92.7458**	**1.3256**	**1.183**	**91.5678**	**93.56984**
14	**1.1300**	**1.4560**	**91.05245**	**92.9457**	**1.3947**	**1.140**	**91.7898**	**93.74568**
15	**1.2022**	**1.5270**	**91.05421**	**93.0243**	**1.4036**	**1.264**	**91.8791**	**93.89569**

INFORMED CONSENT FORM

I_____ agree to participate in the research study conducted by **Mr.P.RANJITH JOEL SIMEON**, 2nd year, M.P.T., [CARDIO RESPIRATORY], **MADHA COLLEGE OF PHYSIOTHERAPY** entitled "**EFFECTIVENESS OF ONE-LEGGED EXERCISE TRAINING IN IMPROVING AEROBIC CAPACITY OF PATIENTS WITH COPD"** Patient. I acknowledge that the research study has been explained to me and I understand that agreeing to participate in the research means that I am willing to,

- Provide information about my health status to the researcher[s].
- Allow the researcher[s] to have access to my professional records pertaining to the purpose of the study
- Participate in training program for duration of two weeks.
- Make myself available for follow up.
- Understand and follow the home advice[s] that will be provided.

I have been informed about the purpose; procedure[s], measurement[s], and risk[s] involved in the research and my queries towards the research and have been clarified.

I provide consent to the researcher to use the information ,video recording[s],for research and educational purpose only.

I understand that my participation is voluntary and can withdraw at any stage of the research project

Name of the participant

Date

Signature